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Reciprocity Outperforms Conformity to Promote Cooperation

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Abstract

Evolutionary psychologists have proposed two processes that could give rise to the pervasive amounts of human cooperation observed among non-genetically related individuals: reciprocity and conformity. We test whether reciprocity outperforms conformity in promoting cooperation, especially in a situation when these psychological processes would promote a different (non)cooperative response. To do so, across three studies we observe cooperation with a partner after learning (a) that their partner has behaved cooperatively (or not) on several previous trials (Reciprocity-to-Cooperate) and (b) that their group members have behaved cooperatively (or not) on several previous trials with that same partner (Conformity-to-Cooperate). Although we find that people both reciprocate and conform, reciprocity has a stronger influence on cooperation. Moreover, we find that conformity can be partly explained by a concern about one's reputation – a finding that supports a reciprocity approach.

Keywords: Reciprocity; Conformity; Cooperation; Culture; Evolution

Reciprocity Outperforms Conformity to Promote Cooperation

Humans cooperate on a grand scale relative to other species. To explain this exceptional ability to cooperate, evolutionary psychologists have suggested that evolutionary processes may have shaped multiple psychological mechanisms that promote identifying opportunities to cooperate and to avoid being taken advantage of by defectors. One theoretical approach to explain the evolution of cooperation is that humans selectively cooperate to acquire direct and indirect benefits (Cosmides & Tooby, 2005; Delton, Cosmides, Guemo, Robertson, & Tooby, 2012; Krasnow et al., 2016). Another theory suggests that imitation and conformity enable people to learn group norms of cooperation (Henrich & Boyd, 2016; Richerson et al., 2015). Each theory has acquired evidence in support of these psychological processes that determine when people choose to cooperate. Yet, no research has been conducted to examine whether reciprocity or conformity carries more or less influence on cooperation, especially in a situation when one process promotes cooperation and the other defection.

We examine whether the psychological mechanisms underlying direct and indirect reciprocity influence cooperation more than those underlying imitation and conformity to cooperative group norms. To do so, we observe how people behave in a cooperative decision making task after learning (a) that their partner has behaved cooperatively (or not) in several previous interactions and (b) that their group members have behaved cooperatively (or not) on previous interactions with that same partner. A conformity approach would predict that people's behavior will track group norms of cooperation. A reciprocity approach would predict that people will condition cooperation on their partner's (expected) behavior. Across three studies, we test competing predictions about how people decide to cooperate (or not) when reciprocity is opposed to conformity. Do people reciprocate partner cooperation, even when they perceive their group has a noncooperative norm? That is, does reciprocity outperform conformity to promote cooperation?

Reciprocity and Cooperation

Humans evolved in small-scale hunter-gatherer societies that included dense networks for social exchange (Cosmides & Tooby, 2005). In this environment, humans evolved a capacity to condition costly cooperation towards partners in situations that could result in direct or indirect benefits. Indeed, evolutionary models suggest that the mechanisms of *direct* reciprocity and *indirect* reciprocity can enable selection for adaptations for conditional cooperation (Nowak & Sigmund, 2005).

The evolved psychological mechanisms underlying reciprocity function to identify opportunities to establish and maintain beneficial relationships (Delton et al., 2012). Such mechanisms should identify cooperators and defectors and condition cooperation towards others who are expected to cooperate in the present or future interactions. Research suggests that people have a specialized ability to identify individuals who have not cooperated in past interactions (Cosmides & Tooby, 2005; Delton et al., 2012). Moreover, people have a strong tendency to cooperate with others they expect to cooperate (Balliet & Van Lange, 2013). This offsets the cost of cooperation by acquiring direct benefits from others' cooperation.

Indirect reciprocity, on the other hand, occurs via a reputation as a cooperator (Panchanathan & Boyd, 2004). Indeed, cooperation can be a successful strategy when that behavior is observed by others and broadcasted to a larger audience, leading to an enhanced cooperative reputation, and this subsequently increases a future partner's tendency to cooperate (Wu, Balliet & Van Lange, 2016). Across the studies, indirect reciprocity will be investigated by testing whether concern about group member evaluations of own behavior (i.e., reputational concern) increases conformity to group member behavior. Additionally, we test whether reciprocity outperforms conformity across anonymous and public decision making settings. Anonymity should suppress the role of indirect reciprocity in promoting cooperation.

Conformity and Cooperation

In those same ancestral, hunter-gather groups described above, people often competed with other groups over scarce resources (Bowles, 2009). According to the gene-culture coevolutionary theory, intergroup competition could have created selection pressure for an ability to acquire group norms, especially norms that promoted cooperation, which led groups to be successful during intergroup competition (Richerson et al., 2015). From this approach, cooperation among non-genetically related individuals can be explained by an ability to follow group norms (Henrich et al., 2015). Indeed, agent-based models suggest intergroup competition can lead to the selection of cooperation with ingroup members (Henrich & Boyd, 1998).

According to this theory, cooperation arises from group norms, which are acquired via imitation and conformity. A conformity psychology involves imitating the most common behavior exhibited in a group (Henrich & Boyd, 2001). A body of research suggests that people possess exceptional skills for imitating others and a strong tendency to conform to group norms (Alpizar et al., 2008). For example, people tend to agree with an ingroup member's answer to a question, even when they know the answer is inaccurate (Asch, 1956). Richerson and Boyd (2001) suggest that humans evolved a capacity to form (subjective) commitments to groups that motivate conformity to group norms.

A gene-culture coevolutionary approach also proposes that people follow prestigious members of a group, i.e. prestige-biased learning (Henrich & Gil-White, 2001). Indeed, people are more likely to imitate highly prestigious individuals in their group (Cartwright, Gillet, & Van Vugt; 2013). Imitation, conformity, and prestige-biased learning should promote group cohesion that would essentially lead to the success of groups in intergroup competition (Boyd & Richerson, 2009; Henrich, 2004).

The Present Research

The two theories summarized above—Reciprocity and Conformity—are not mutually exclusive, but the psychological mechanisms posited under each theory may compete for influence over when people choose to cooperate. Here we examine how people decide to cooperate in situations when the two theories predict a different cooperative response. Do people generally follow group norms of cooperation, even when reciprocity would promote noncooperation? Do people reciprocate cooperation, even in the presence of a noncooperative group norm?

To address these questions, we revisit the Asch Conformity Paradigm (Asch, 1956) by observing how people behave in a cooperative decision making task with another person after they learn how that person behaved on previous trials with other group members. Similar to the Asch paradigm, group members have a consistent behavioral response (i.e., cooperate or defect). However, our methods differ from the Asch paradigm by involving a social interaction that can affect the participant's outcomes. Moreover, participants observe consistent partner behavior on several previous trials (i.e., cooperate or defect). In Study 3, we add a prestigious member to the group to increase conformity. In Study 3, we also manipulate anonymity of the participants' decisions to reduce the impact of (indirect) reciprocity.

If conformity outperforms reciprocity, individuals will imitate group members' behavior, regardless of their partner's cooperation on previous trials. However, if reciprocity outperforms conformity, then people will base their decisions on their partner's previous behavior, regardless of their group members' behavior. We also test if cooperation is better explained by psychological mechanisms of imitation and conformity (e.g., subjective commitment and group norms) or the (in)direct benefits of reciprocity (e.g., expectations of partner cooperation and reputational concern).

Study 1

Method

Participants and procedure. Across all the studies, an a-priori power analysis (G*Power; Faul, Erdfelder, Buchner, & Lang, 2009) revealed a required sample size of 704 to achieve statistical power of .80 to detect an effect size of $d = 0.30$. Participants ($N = 704$; 329 women, $M_{\text{age}} = 36.54$ years, $SD = 11.32$) were recruited from Amazon Mechanical Turk (MTurk) and completed the online study for \$1.20. Moreover, participants earned lottery tickets based on their decision. Twenty participants won a \$2 prize. Importantly, MTurk provides reliable and valid data comparable to lab experiments (Casler, Bickel, & Hackett, 2013), with the advantage of providing relatively heterogeneous samples, e.g., socio-economic and ethnic diversity (Paolacci & Chandler, 2014). Moreover, previous research has used MTurk to successfully study the social processes we observed in our research (Bostyn & Roetz, 2016; Laporte, Van Nimwegen, & Uyttendele, 2010; Nook et al., 2016). We required participants to be located in the United States and have a successful HIT rate of at least 85%. The study was a 2 (Group Behavior: cooperative vs. noncooperative) \times 2 (Partner Behavior: cooperative vs. noncooperative) between-subjects design.

Participants provided informed consent and were told that they were online with five other participants. Then, they were told that the experiment was divided in two parts. The first part required participants to interact with five other participants in a task (labeled the survival task), which was intended to form a cohesive group. In the second part, participants interacted with another person in a prisoner's dilemma (PD). Participants were told that they would interact in the PD with a new participant called Person B who did not participate in the survival task. However, before making their decisions, they received information about how each group member behaved with Person B in the PD, and how Person B behaved with the other group members.

Survival task. In the first part of the study, participants played an activity called ‘Survival Task’. We used the survival task to increase participants’ cohesiveness in a group (Zaccaro & McCoy, 1988). This type of task has been widely employed to promote group cohesion (for meta-analyses, see Beal et al., 2003; Evans & Dion, 1991). In this task, participants imagined that their spaceship, directed to the moon, has crashed and that they must travel 200 miles to reach the rendezvous point. However, they cannot bring all their equipment and must make some tough decisions to survive. For this reason, they had to prioritize a list of 15 items according to their survival value. The goal was to match their ranking with the one provided by survival experts (Carpenter & Radhakrishnan, 2002). They were told that their score would be combined with the other five participants who were ostensibly online. Next, they were asked to imagine a conversation with the crew about the best strategy in this situation (Meleady, Hopthrow & Crisp, 2013).

We first conducted a pilot study to test whether this task also promoted cohesion in online groups. In this study, cohesiveness was measured with six items on a seven-point Likert scale ($\alpha = .95$; Chin et al., 1999). We recruited 150 participants via MTurk and randomly assigned participants to one of three conditions: interaction with six members of the crew, interaction with two members of the crew, and no interaction with the other members. In the latter condition, participants were told that there were five other participants online, but that they were independent and making decisions that only affected their own survival. Then, in this condition, participants imagined a discussion about the task with a stranger. There was significantly more group cohesion when participants interacted with all group members ($M = 5.43$, $SD = 1.24$), compared to no interaction with group members ($M = 3.79$, $SD = 1.59$; $t(97) = 5.75$, $p < .001$, $d = 1.16$). There was no significant difference between the interaction with six members and two members ($p = 0.21$).

Prisoner's dilemma. Participants interacted in a prisoner's dilemma (PD) task (Van Lange & Kuhlman, 1994). In the PD task, participants and their partner were endowed 100 tickets and had to decide how many tickets to give to their partner (0-100). Each ticket represented a 0.01% chance to win a 2-dollar bonus. Each lottery ticket given to their partner would be doubled. This is a PD because the best outcome (300 tickets) results from keeping the entire endowment and benefiting from the partner giving their entire 100 tickets. However, each person earns more tickets if each person decides to give their entire 100 tickets to their partner (200 tickets), compared to when each person decides to keep their 100 tickets for themselves (100 tickets). The worst outcome (0 tickets) occurs when a person gives their entire 100 tickets to their partner, but their partner does not give them any tickets.

Group member behavior and partner behavior. Before making their decisions in the PD, participants were told that they (and all the other group members as well) had the possibility to observe how their future partner (Person B) behaved with each member of the group and vice versa. Before making their decisions, participants could observe a screen with two columns: one containing decisions from each group member, and the other column containing each decision of Person B while interacting with each group member. Participants were always the last person in their group to make a decision. The information about group member behavior and Person B's behavior was presented to participants with an average of 9 seconds between decisions.

Group member behavior and partner behavior were manipulated to be either cooperative or noncooperative. In the cooperative group and cooperative partner condition, each group member gave their entire endowment to Person B (99, 91, 91, 96, and 100) while Person B gave similarly large amounts to group members (97, 93, 92, 100, and 95). In the noncooperative group and noncooperative partner condition, each group member consistently gave almost nothing to Person B (5, 3, 6, 4, and 2), while Person B gave similarly low

amounts to group members (4, 3, 7, 1, and 5). In the cooperative group and noncooperative partner condition, the five group members gave nearly all of their endowment to Person B (99, 91, 91, 96, and 100), while Person B gave each group member almost nothing (5, 3, 6, 4, and 2). In the noncooperative group and cooperative partner condition, these payoffs were simply reversed. Therefore, we created a situation where group members gave almost nothing in the PD to Person B, while Person B continued to be cooperative and give their entire endowment to group members. We refer to this as the *Reciprocate-to-Cooperate Condition*, since cooperation in this condition would be influenced by reciprocating partner (expected) behavior. Conversely, we had a situation when all group members decided to cooperate, but Person B was consistently noncooperative. We refer to this as the *Conform-to-Cooperate Condition*, since cooperation in this condition would be influenced by conformity to group member behavior. These are the two conditions that enable a test of competing predictions, while the other two conditions involve both the group members and Person B always cooperating or not cooperating with each other.

Results

We conducted a 2×2 ANOVA with group member behavior and partner behavior predicting cooperation. This analysis revealed a main effect of group member behavior, $F(1,700) = 22.88; p < .001, d = 0.36$. Participants cooperated more when group members were cooperative ($M = 41.28, SD = 42.52$), than when group members were noncooperative ($M = 29.61, SD = 34.97$). Also, participants cooperated more with a cooperative partner ($M = 51.98, SD = 41.44$) than a noncooperative partner ($M = 18.99, SD = 28.92$), $F(1, 700) = 174.99, p < .001, d = 0.98$. There was a significant interaction between group member behavior and partner behavior predicting cooperation, $F(1, 700) = 86.01, p < .001, \eta^2_p = .11$. Of course, people were more cooperative when both their group and their partner were cooperative during previous interactions ($M = 69.82, SD = 36.45$), compared to when both

their group and their partner were noncooperative ($M = 24.64$, $SD = 30.22$), $t(347) = 12.62$, $p < .001$, $d = 1.35$. We can test if reciprocity or conformity were relatively more influential by examining how people cooperate in the conditions where group member behavior deviates from partner behavior. People were more cooperative in the condition with a noncooperative group and cooperative partner ($M = 34.55$, $SD = 38.57$), compared to the condition with a cooperative group and a noncooperative partner ($M = 13.37$, $SD = 26.48$), $t(352) = 6.02$, $p < .001$, $d = 0.64$. Therefore, we observe greater cooperation in the Reciprocate-to-Cooperate condition, than the Conform-to-Cooperate condition (see Figure 1). This is initial evidence that reciprocity outperforms conformity when these two processes conflict to influence how people decide to cooperate.

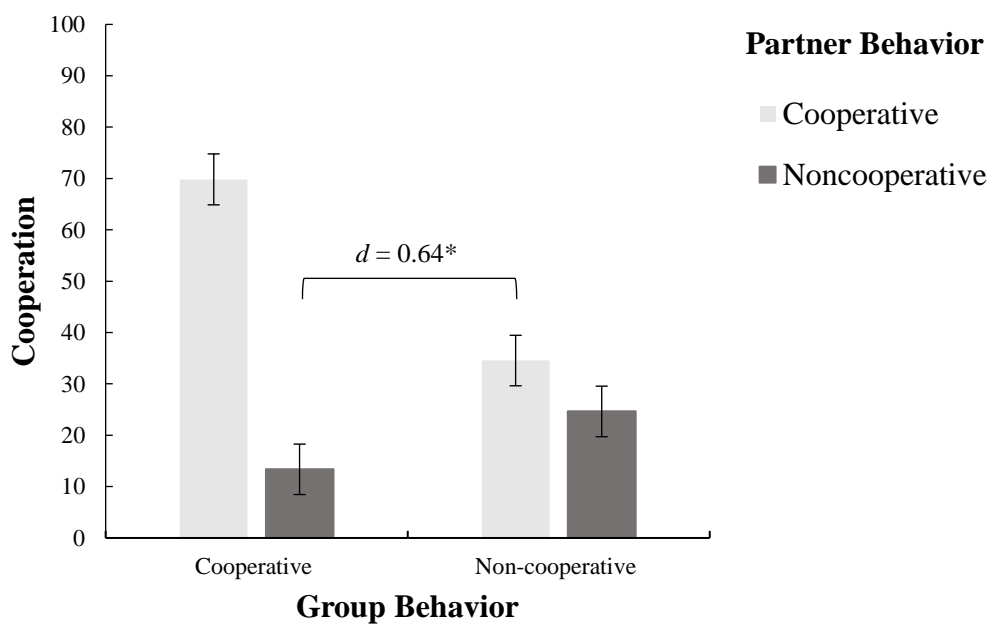


Figure 1. Means and 95% CI of the effect of group and partner behavior on cooperation, * $p < .05$.

Study 2

Method

We created a few modifications to the study design to further test the conformity and reciprocity accounts of cooperation. First, we manipulate knowledge about the partner's prior behavior with group members (known or unknown). If people conform in our paradigm, then

the lack of information about partner behavior should result in an even stronger influence of group member behavior on decisions to cooperate. Second, we measure and test two competing psychological processes that are hypothesized to affect when people cooperate; expectations of partner cooperation and perceived group norms. Finally, we test the moderating role of reputational concern and subjective commitment to the group. According to an indirect reciprocity approach, people may cooperate according to group expectations because they are observed and their behavior can lead to indirect benefits (Wu et al., 2015). According to a conformity approach, people only follow group norms of cooperation when they have high levels of subjective commitment to the group (Richerson & Boyd, 2001). Yet, when people have low subjective commitment to the group (or do not care about their reputation in the group), then people will be less likely to conform to group norms of cooperation, and will be relatively more inclined to reciprocate partner cooperation.

Participants and procedure. Participants ($N = 701$; 342 women, $M_{\text{age}} = 35.07$ years, $SD = 11.33$) were recruited from MTurk and completed the study for \$1.20. Twenty participants were assigned a \$2 prize. Sample size and characteristics are reported after excluding 3 participants who had participated in the previous study. Participants were excluded after matching their MTurk ID with the IDs from the previous study. The study consisted of a 2×2 between-subjects design. The participants were randomly assigned to either a Reciprocate-to-Cooperate condition (i.e., group member noncooperation, but partner cooperation) or a Conform-to-Cooperate condition (i.e., group member cooperation, but partner noncooperation). Participants were also randomly assigned to a condition when they had information about their partner's previous behavior (as in Study 1) or they did not have information about their partner's previous behavior (but continued to have information about their group member's behavior).

The procedure is similar to Study 1. As in Study 1, participants (1) were told that they were interacting with a group of people currently online, (2) completed the survival task to increase group cohesion, and (3) interacted with an additional person who did not participate in the survival task in a PD (Person B). However, participants were randomly assigned to either (a) observe how each group member and Person B behaved in the PD or (b) observe group member behavior, but not Person B's behavior in the PD. After participants decided how much to give Person B, we administered a measure of expected partner cooperation, perceived group norm, reputational concern, and subjective commitment to the group.

Expectations of partner cooperation. Participants estimated how many lottery tickets they expected Person B to give them (0-100).

Perceived group norm of cooperation. We asked participants how many lottery tickets they thought their group members expected they should give to Person B. We asked a general question about the perceived group norm (e.g., *"How many lottery tickets do your group members think you should give to Person B?"*), and also a single question for each of the other members of the group ($\alpha = .99$, e.g., *"How many lottery tickets does Participant_1 think you should give to Person B?"*).

Reputational concern. Participants completed a measure of reputational concern (see Wu, Balliet, & Van Lange, 2015). In this measure, participants rate their agreement with four items (e.g., *"During the decision making task, I thought about how the other group members would think about me"*) on a 5-point Likert scale (1 = totally disagree, 5 = totally agree; $\alpha = .88$). Higher scores indicate higher reputational concern.

Subjective commitment. Subjective commitment to a group involves the sense of belonging and concern for a group (Richerson & Boyd, 2001). Therefore, we had participants complete a perceived cohesion scale as a proxy of subjective commitment to the group (Chin et al., 1999; e.g., *"I am happy to be part of this group"*, *"I see myself as part of this group"*).

Participants responded to six items using a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree; $\alpha = .95$). Higher scores indicate higher subjective commitment.

Results

Manipulation checks. When participants observed Person B's behavior during the previous interactions, they expected more cooperation from Person B when Person B was cooperative ($M = 74.87$, $SD = 31.92$), compared to noncooperative in prior interactions ($M = 12.98$, $SD = 22.34$), $t(343) = 20.83$, $d = 2.24$. In fact, even when participants did not observe Person's B behavior they expected more cooperation from Person B in the cooperative group condition ($M = 53.47$, $SD = 33.30$), compared to the noncooperative group condition, ($M = 21.64$, $SD = 26.76$), $t(346) = 9.81$, $d = 1.05$.

The manipulation of group member cooperation affected whether participants perceived the group as having a cooperative or noncooperative norm. Participants thought that greater cooperation was expected by group members in the cooperative group members condition ($M = 77.04$, $SD = 32.66$), compared to noncooperative group members condition ($M = 10.86$, $SD = 16.38$), $t(699) = 33.89$, $d = 2.56$. Because both manipulations were associated with strong effect sizes, we conclude that participants accurately perceive when their group and partner are cooperative or noncooperative.

Cooperation. We conducted a 2 (Reciprocate-to-Cooperate vs. Conform-to-Cooperate) \times 2 (Partner Knowledge vs. Partner Behavior Unknown) ANOVA predicting cooperation. Most relevant to our hypotheses, we found a significant interaction predicting cooperation, $F(1, 697) = 59.90$, $p < .001$, $\eta^2_p = .079$. Replicating findings from Study 1, when participants could observe Person B's prior behavior, then participants were more cooperative in the reciprocate-to-cooperate condition ($M = 31.41$, $SD = 36.00$), compared to the conform-to-cooperate condition ($M = 23.57$, $SD = 33.25$), $t(346) = 2.11$, $p = .03$, $d = 0.23$ (see Figure 2). However, when participant's did not observe Person B's prior behavior, they were more

cooperative in the presence of a cooperative group ($M = 54.98$, $SD = 39.63$), than a noncooperative group ($M = 22.34$, $SD = 28.54$), $t(351) = -8.87$, $p < .001$, $d = -0.94$.

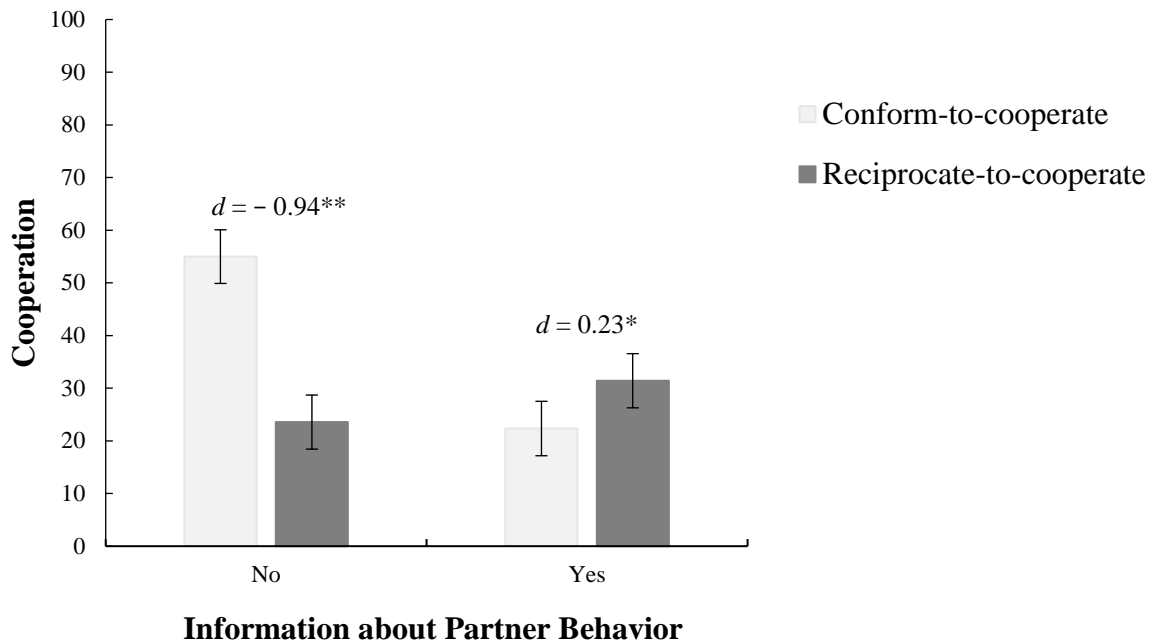


Figure 2. Means and 95% CI on how the conformity/reciprocity conditions and information about partner behavior influence cooperation; * $p < .05$.

Reputational concern and subjective commitment. A multiple regression model was constructed in which cooperation was regressed onto the reciprocity/conformity conditions (0 = conform-to-cooperate; 1 = reciprocate-to-cooperate), partner knowledge conditions, reputational concern, subjective commitment, the two-way interactions (reciprocity/conformity conditions \times reputational concern; reciprocity/conformity conditions \times subjective commitment) and the three-way interactions (reciprocity/conformity conditions \times partner knowledge conditions \times reputational concern; reciprocity/conformity conditions \times partner knowledge conditions \times subjective commitment). All predictors were mean centered. Reputational concern and subjective commitment did not have a significant main effect on cooperation (see supplemental materials for complete report of the model).

There was a significant interaction between the reciprocity/conformity conditions and reputational concern predicting cooperation, $b = 14.63$, $t(689) = 5.87$, $p < .001$ (see Figure 3).

We further examine this interaction in the condition which is replicated across the three studies in our paper (i.e., the condition with information about partner behavior), in order to facilitate the comparison of results across the studies. At low levels of reputational concern ($-1 SD$), people were more inclined to reciprocate than conform, $t(347) = 6.52, p < .001, d = 0.70$. But for high levels of reputational concern ($+1 SD$) people were more inclined to conform than reciprocate, $t(347) = -3.35, p < .001, d = -0.36$. The same pattern of interaction was found between the reciprocity/conformity conditions and levels of subjective commitment, $b = 5.56, t(689) = 2.96, p = .003$ (Figure 3). At low levels of subjective commitment ($-1 SD$), people were more inclined to reciprocate than conform, $t(347) = 4.99, p < .001, d = 0.54$, but at high levels of subjective commitment ($+1 SD$) people were more inclined to conform than reciprocate, $t(347) = -2.01, p = .04, d = -0.22$.

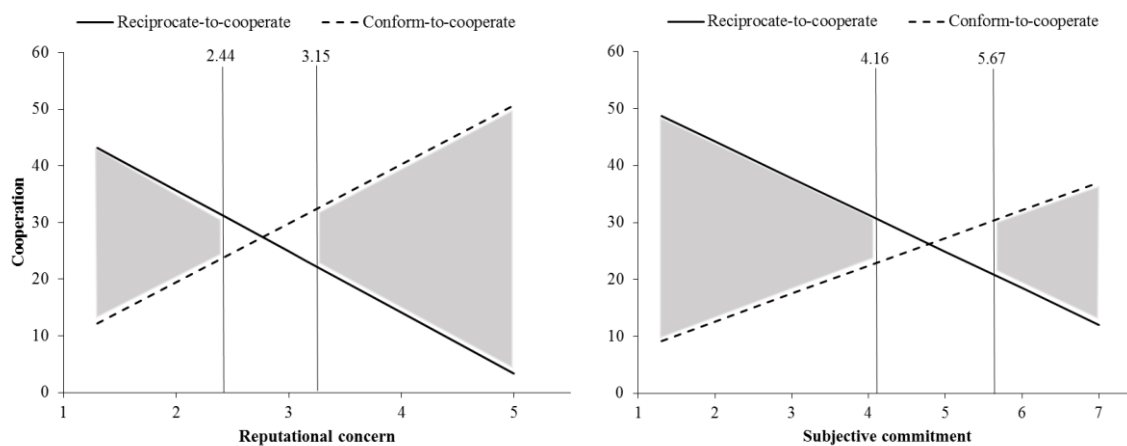


Figure 3. Floodlight of the regions of reputational concern and subjective commitment for which there is a statistically significant effect of the reciprocity/conformity conditions on cooperation.

Mediation model. We tested whether the reciprocity/conformity conditions influenced cooperation through the mediation of perceived group norms and expectations of partner cooperation using the bootstrapping method for multiple mediation (Preacher & Hayes, 2008). We test this model in the condition when partner information was present to make comparisons with Study 1. The results show significant indirect effects of both expectations of partner cooperation, $b = 13.55, 95\% CI [4.84, 22.98]$, and perceived group

norms, $b = -12.07$, 95% CI $[-17.48, -7.04]$. The total effect of reciprocity/conformity on cooperation (total effect = 7.84, $p = .037$, 95% CI $[0.47, 15.20]$) became nonsignificant when the mediators were included in the model (direct effect = 6.36, $p = .31$, 95% CI $[-5.90, 18.61]$).

We also tested the same model when partner information was absent. The results show significant indirect effects of both expectations of partner cooperation, $b = 22.79$, 95% CI $[17.61, 28.75]$, and perceived group norms, $b = 17.16$, 95% CI $[3.30, 31.91]$. The total effect of reciprocity/conformity on cooperation (total effect = 33.14, $p < .001$, 95% CI $[25.85, 40.44]$) became nonsignificant when the mediators were included in the model (direct effect = -6.80 , $p = .34$, 95% CI $[-20.77, 7.17]$). These results suggest that people were using group member behavior to infer partner behavior, which influenced cooperation.

Study 3

Method

Although participants displayed conformity to group norms of cooperation in both Studies 1 and 2, we found that they were more inclined to reciprocate partner cooperation than conform to group norms of cooperation. Nonetheless, the previous studies lacked an important feature of learning group norms – a prestigious group member. Therefore, in Study 3 we replicate the previous paradigm, but now include a prestigious member in the group. The implementation of the prestigious member is not a manipulated variable in this study, but is used to create a situation that will produce even stronger group conformity.

In Study 2, we also found that reputational concern influenced when people decided to conform to group norms of cooperation. Thus, people may be cooperative in groups to acquire indirect benefits of cooperation – a finding more aligned with a reciprocity approach compared to a gene-culture coevolutionary approach. Therefore, to reduce the possibility of reputational concern we also manipulated the anonymity of cooperation decisions. According

to a reciprocity perspective, anonymity does not provide an opportunity for indirect reciprocity, so anonymity should reduce the influence of group member behavior on cooperation. A gene-culture coevolutionary approach, however, does not predict that anonymity will affect how individuals conform to group norms of cooperation.

Participants and procedure. Participants ($N = 699$; 407 women, $M_{\text{age}} = 35.96$ years, $SD = 11.21$) were recruited from MTurk and completed the study for \$1.20. Twenty participants won a 2 dollars prize. Sample size is reported after excluding 5 participants who had participated in the previous studies. The study was a 2 (reciprocate-to-cooperate vs. conform-to-cooperate) \times 2 (public monitoring vs anonymity) between-subjects design.

The procedure is the same as the previous studies, with two exceptions: (1) the addition of a prestigious member to the group and (2) a manipulation of anonymity. Participants first completed the survival task (where we now establish a prestigious member of the group, see below), and then interacted with a non-group member (Person B) in the PD. Participants were told that they could observe how each member of the group and Person B behaved in the previous interactions. After that, participants were randomly assigned to one of two conditions; (1) a situation where others could observe their choice (i.e., the same situation as the previous Studies) or (2) that their choice was anonymous. Lastly, participants completed the measures of expected partner cooperation, perceived group norm of cooperation, reputational concern ($\alpha = .88$) and subjective commitment to the group ($\alpha = .95$).

Prestigious member. Prestigious group members usually have some particular skills within the group and are considered the most important members (Henrich, Chudek, & Boyd, 2015). Here, the prestigious group member was determined by successful decisions in the survival task that benefitted the group survival. Participants were told that their survival depended on their own and group members' choices, and that group members would be rank ordered based on how well their decision benefitted the survival of the group. The top ranked

individual was the prestigious member. As a manipulation check, we asked participants to select who they thought was the most important member of the group. As expected, 92% of participants considered the 1st ranked individual as the most important member in the group. The other group member decisions followed the same structure as previous studies. However, the prestigious member always made the fourth decision with Person B. Participants observed how the prestigious member behaved towards Person B, which was 100 or 0, respectively.

Public monitoring vs anonymity conditions. In the public monitoring condition, participants were told that although they were the last to make a choice in the PD task, the other five members of their crew would observe how they behaved towards Person B. By contrast, in the anonymity condition, participants were told that since they were the last to make a choice in the PD task, then the other five members would not observe their behavior.

Results

Manipulation checks. Participants expected greater partner cooperation after observing their partner cooperate on several previous trials ($M = 74.64$, $SD = 30.47$), compared to when their partner did not cooperate ($M = 13.81$, $SD = 23.76$), $t(697) = 29.39$, $d = 2.22$. Also, people perceived a cooperative group norm when their group members were consistently cooperative ($M = 63.09$, $SD = 39.36$), compared to noncooperative ($M = 18.32$, $SD = 24.96$), $t(697) = -17.98$, $d = -1.35$.

Cooperation. A 2×2 ANOVA shows a main effect of the reciprocity/conformity conditions, $F(1,695) = 4.24$; $p = .04$, $d = 0.16$. Participants cooperated more in the reciprocate-to-cooperate condition ($M = 32.45$, $SD = 36.79$), compared to the conform-to-cooperate condition ($M = 26.62$, $SD = 35.71$). There was not a significant main effect of anonymity, $F(1,695) = 1.20$; $p > .25$. There was also not a significant interaction between the reciprocity/conformity conditions and anonymity, $F(1,695) = 0.16$; $p > .25$.

Reputational concern and subjective commitment. We conducted a multiple regression analysis in which cooperation was regressed onto the reciprocity/conformity conditions (0 = conform-to-cooperate; 1 = reciprocate-to-cooperate), anonymity condition reputational concern, subjective commitment, the two-way interactions (reciprocity/conformity conditions \times reputational concern, reciprocity/conformity conditions \times subjective commitment), and the three-way interactions (reciprocity/conformity conditions \times anonymity conditions \times reputational concern; reciprocity/conformity conditions \times anonymity conditions \times subjective commitment). All the predictors were mean centered. The interaction term between the reciprocity/conformity conditions and reputational concern was significant, $b = -12.00$, $t(692) = -4.64$, $p < .001$ (Figure 4). Examining the simple effects, at low levels of reputational concern ($-1 SD$), people were more inclined to reciprocate than conform, $t(697) = 6.14$, $p < .001$, $d = 0.46$. However, at high levels of reputational concern ($+1 SD$), people were more inclined to conform than reciprocate, $t(697) = -3.09$, $p < .001$, $d = -0.23$. We observed a similar pattern of interaction between reciprocity/conformity conditions and subjective commitment predicting cooperation, $b = -5.23$, $t(692) = -2.84$, $p = .005$ (Figure 4). At low levels of subjective commitment ($-1 SD$), people were more inclined to reciprocate than conform, $t(697) = 5.05$, $p < .001$, $d = 0.38$. However, at high levels of subjective commitment ($+1 SD$), people were more inclined to conform than reciprocate, $t(697) = -2.17$, $p = .03$, $d = -0.16$.

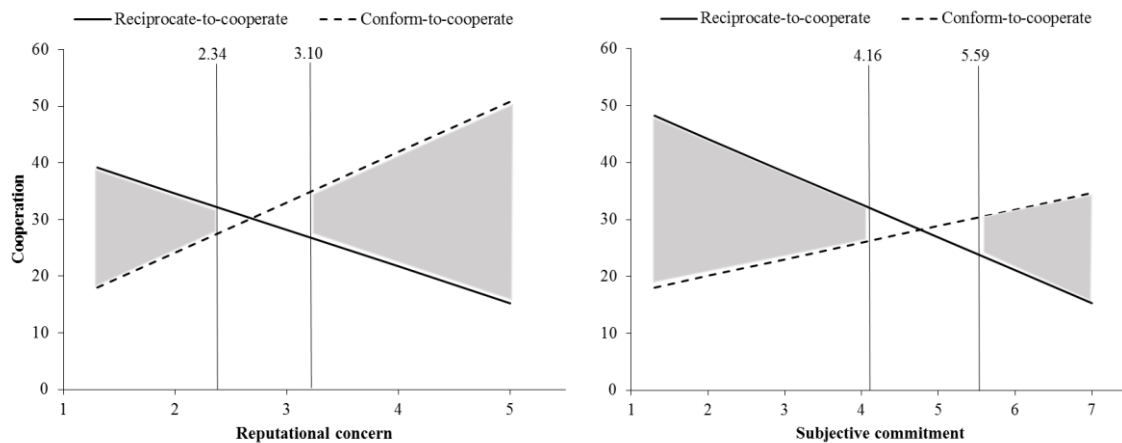


Figure 4. Floodlight of the regions of reputational concern and subjective commitment for which there is a statistically significant effect of the reciprocity/conformity conditions on cooperation.

Mediation analysis. We tested whether the reciprocity/conformity conditions influenced cooperation through the mediation of group norms and expectations of partner cooperation using the bootstrapping method for multiple mediation (model 4, Preacher & Hayes, 2008). Replicating Study 2, there is a significant indirect effect of both expectations of partner cooperation, $b = 12.97.12$, 95% CI [6.33, 19.51], and perceived group norms, $b = -9.94$, 95% CI [-13.84, -6.01]. The total effect of reciprocity/conformity on cooperation (total effect = 5.82, $p = .03$, 95% CI [0.43, 11.21]) became nonsignificant when the mediators were included in the model (direct effect = 2.79, $p = .53$, 95% CI [-5.89, 11.46]).

General Discussion

An emerging consensus between the social and biological sciences is that humans evolved to cooperate – and so engage in costly behaviors that benefit others. Yet, how humans evolved to cooperate is still intensely debated. One approach stresses the importance of direct and indirect benefits of reciprocity in small hunter-gatherer societies (Cosmides & Tooby, 1992). Another approach emphasizes how people learn norms, including norms to cooperate (Henrich, 2004). Perhaps people evolved to reciprocate *and* to learn norms of cooperation, and each mechanism competes for influence over decisions to cooperate. The

primary goal of the present research was to test whether reciprocity or conformity would constrain the influence of the other psychological mechanism to affect cooperation.

To examine this issue, we placed people in a group and then had them interact with a non-group member in a cooperation task. Before participants made their own decisions, they observed their group members cooperate (or defect) with the same non-group member who defected (or cooperated). Across the three studies, when partner behavior deviated from the group behavior, then people adjusted their behavior to their partner's behavior. That is, people displayed a stronger tendency to reciprocate partner (expected) cooperation compared to conform to group norms of cooperation (random effect meta-analysis across 3 studies; $n = 1401$; $d = 0.34$, 95% CI [0.05, 0.64]). In fact, reciprocity outperformed conformity even in Study 3 when prestige-biased social learning could enhance learning of social norms and anonymity could decrease the role of indirect reciprocity.

A few additional findings support that reciprocity can have a relatively stronger influence than conformity in regulating how people cooperate. First, conformity in our studies can be partly explained by reputation-based indirect reciprocity. People tended to conform when they had high reputational concern, but when people didn't care about how group members would evaluate their behavior, then they reciprocated partner behavior. Second, we observed the largest amount of cooperation when both the group and partner were cooperative on previous trials. So, norms of cooperation are much easier to arise and be maintained when they correspond with what would be promoted by a psychology that evolved to reciprocate. Third, people did not behave differently across public and anonymous situations in responding to reciprocity opportunities, suggesting that cues of reciprocity can regulate cooperation in the absence of the threat of social evaluations and sanctions (Delton et al., 2011). Finally, even when we did not provide information about partner behavior (Study 2),

people tended to use group member behavior to infer expected partner behavior, and then conditioned behavior on those expectations – further supporting a reciprocity account.

In support of a gene-culture coevolutionary approach, we found that variation in subjective commitment to the group influenced when people tended to conform to the group. At high levels of subjective commitment to the group, people tended to conform to the group, as opposed to reciprocate partner cooperation. Thus, a gene-culture coevolutionary theory may apply to predict behavior at sufficiently high levels of subjective commitment. Future research can examine the factors that give rise to sufficient levels of subjective commitment (e.g. intergroup competition, group success, and high interdependence among group members). Although there was a medium-sized correlation between subjective commitment and reputational concern (random effects meta-analysis, $r = 0.43$, 95% CI [0.39, 0.48]), each motivation explained unique variation in when people conformed to the group versus reciprocated partner cooperation. Future research can further examine these two motivations underlying why people conform to norms of cooperation.

Our studies used online methods, which might fail to elicit the emotional and motivational responses that would promote conformity during interactions with group members who are present and visible – similar to the original Asch studies (1956). Importantly, the same is true for reciprocity – when interaction partners are present (and visible) people can use many cues to predict a partner's behavior and this can promote reciprocity and cooperation (Drolet & Morris, 2000). In our studies, we had a total of five group members who all behaved similarly, a situation that is known to elicit strong conformity (Asch, 1956). Indeed, we observed conformity to group norms of cooperation in our online task, especially in Study 2 when we did not provide information about their partner's previous behavior. Our use of an online experimental environment provides a clean, replicable, methodology that can harness the statistical power of larger sample sizes.

Numerous adaptive problems involve cooperation, such as selecting and maintaining beneficial relationships, increasing reputational standing in a group, and success during intergroup competition. Thus, evolution may have shaped numerous psychological processes that affect when and how people cooperate. These psychological processes would operate in parallel and could potentially compete for influence over when people cooperate. Here we constructed a decision environment where reciprocity and conformity predicted a different (non)cooperative response. We found that people were more inclined to reciprocate than conform. Thus, the relatively phylogenetically ancient psychological mechanisms of cheater detection and reciprocity may claim relatively greater influence over decisions to cooperate. Such evidence enlightens us about the conditions when specific psychological mechanisms apply to explain cooperation.

Author Contributions

Angelo Romano and Daniel Balliet developed the study concept. Angelo Romano and Daniel Balliet contributed to the study design. Testing and data collection were performed by Angelo Romano. Angelo Romano performed the data analysis and interpretation under the supervision of Daniel Balliet. Angelo Romano drafted the manuscript, and Daniel Balliet provided critical revisions. All authors approved the final version of the manuscript for submission.

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